

CLAIMS

What is claimed:

1. A sintered porous composite material comprising:

a porous base material; and

a layer of porous sintered nanoparticle material, said layer of porous sintered nanoparticle material on one or more surfaces of the porous base and penetrating a portion of said porous base material, said porous sintered nanoparticle material having pores smaller than the pores in said porous base material.
2. The sintered porous composite material of Claim 1, wherein said sintered nanoparticle material is comprised of metals, metal alloys, and mixtures of these materials.
3. The sintered porous composite material of claim 1 wherein said porous sintered nanoparticle material includes nickel.
4. The sintered porous composition of claim 1 wherein said porous sintered nanoparticle material includes sintered dendritic nanoparticles.
5. The sintered porous composite material of claim 1 further comprising a gas, liquid, supercritical fluid or mixtures of these in the pores of said porous sintered nanoparticle material.
6. The sintered porous composite material of claim 1 further comprising:

a housing wherein said sintered porous composite material is bonded to said housing, and wherein said housing with the bonded sintered porous composite material is characterized in that it has a sieving LRV of at least 2 for 0.2 μm particles in a fluid.

7. A filter element comprising:

a porous base material and a layer of porous sintered nanoparticle material formed by sintering a powdered nanoparticle material layer penetrating a portion of said porous base, said layer of porous sintered nanoparticle material on one or more surfaces of the porous base, said porous sintered nanoparticle material having pores smaller than the pores in said porous base.
8. The filter element of Claim 7, wherein said sintered nanoparticle material is comprised of metals, metal alloys, and mixtures of these materials.
9. The filter element of claim 7 further comprising:

a housing wherein said filter element is bonded to said housing, and wherein said housing with the bonded filter element is characterized in that it has a sieving LRV of at least 2 for 0.2 μm particles in a fluid.
10. A sintered porous composite material comprising:

a porous sintered metal base material;

a layer of porous sintered nanoparticle material on one or more surfaces of a porous base and penetrating a portion thereof; and,

a porous sintered nanoparticle material within the base pores, forming a substantially continuous structure and having interconnected pores smaller than the pores in said porous base material.
11. The sintered porous composite material of Claim 10, wherein said sintered nanoparticle material is comprised of metals, metal alloys, and mixtures of these materials.
12. A method of making a porous composite material comprising:

sintering a layer of powdered nanoparticles on a porous base material to form a layer of porous sintered nanoparticle material on said base, said layer said of

powdered nanoparticle on one or more surfaces of the porous base and penetrating a portion of said porous base material.

13. The method of claim 12 further comprising the act of forming said layer of powdered nanoparticles on said porous base material by isostatically pressing said powdered nanoparticles into said porous base.
14. The method of Claim 12, wherein said sintered nanoparticle material layer is comprised of metals, metal alloys, and mixtures of these materials.
15. A method for removing material from a fluid comprising:

flowing a fluid having said material therein through the sintered porous composite material of claim 1 wherein the said sintered porous composite material removes said material from the fluid.
16. The method of claim 15 wherein said material is removed by particle capture.
17. The method of claim 15 wherein said fluid is a supercritical fluid.
18. A supercritical fluid that deposits less than 300 particles greater than 0.2 microns in size on a 200 millimeter diameter substrate when 5 liters of said supercritical fluid are filtered through the porous composite material of claim 1.
19. An apparatus for removing contaminants from a fluid stream comprising:

a housing for containing a bed material;

a second filter element that is a sintered porous composite material having nanometer sized pores, said second filter element secured to said housing to permit fluid flow through the apparatus, the bed material, and said second filter element, said second filter removing particles from said fluid stream;

a bed of material covering said second filter element and contained within said housing, said bed removing contaminants from said fluid stream; and

a first filter element secured to the housing that retains the bed material within the housing between the first filter element and the second filter element, said first filter element permitting fluid flow through the apparatus.

20. A supercritical fluid with less than 50 particles per milliliter, said particles having a size of 0.2 micrometers or less.
21. A sintered porous composite material comprising:

a porous base material; and

a layer of porous sintered nanoparticle material, said layer of porous sintered nanoparticle material on one or more surfaces of the porous base and penetrating a portion of said porous base material, said porous sintered nanoparticle material having pores smaller than the pores in said porous base material; said porous composite material is characterized in that it has an LRV of at least 2 for a 0.2 μm or larger particles in water.
22. The sintered porous composite material of claim 21 wherein said material is characterized in that it has an LRV of at least 4 for a 0.2 μm particle challenge in water.
23. The sintered porous composite material of claim 21 wherein said material is characterized in that it has an LRV of at least 2 for a 0.05 μm particle challenge in water.
24. The sintered porous composite material of claim 21 wherein said material is characterized in that it has an LRV of at least 4 for a 0.05 μm particle challenge in water.
25. The sintered porous composite material of claim 21 having a pressure coefficient in nitrogen of less than 250.
26. The sintered composite material of claim 21 able to support a differential pressure across the material of greater than 60 psi.

27. The sintered composite material of claim 21 wherein the thickness of the porous sintered nanoparticle material is less than 100 microns.
28. The sintered composite material of claim 21 wherein the porous sintered nanoparticle material include particles less than 1000 nm.